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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,811	06/19/2001	Richard W.D. Booth	069804-0187	4376

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EXAMINER
AHN, SAM K

ART UNIT	PAPER NUMBER
2611	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	Application No.	Applicant(s)
	09/885,811	BOOTH ET AL.
	Examiner	Art Unit
	Sam K. Ahn	2611

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 March 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 September 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see p.8, filed 03/09/07, with respect to the rejection(s) of claim(s) 3-7 under 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Wessel et al. US 6,275,685 B1 (Wessel) and Khatibzadeh et al. US 6,975,686 B1 (Khatibzadeh).

Claim Rejections - 35 USC § 112

2. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 2 recites the limitation "the input signal" in line 5 and “the IQ modulator” in line 10. There is insufficient antecedent basis for this limitation in the claim. The limitation of “the input signal” appears to be referring a phase-modulated signal and/or an amplitude signal, thus is unclear which among the two signal or both the input signal it is referring to.

Furthermore, the limitation of “the IQ modulator” appears to be referring back to the IQ demodulator in line 9, however, a modulator and a demodulator have reverse operation, hence it is unclear if the applicants are attempting to recite a modulator or a demodulator.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wessel et al. US 6,275,685 B1 (Wessel) in view of Khatibzadeh et al. US 6,975,686 B1 (Khatibzadeh).

Regarding claim 1, Wessel teaches a method of generating feedback information in IQ (In-phase and Quadrature) form for linearity compensation of a communications transmitter using polar modulation and having a communications signal amplifier having an input signal and producing an output signal (see Fig.4), comprising: using the output signal, producing an output measurement signal (signal 50 in Fig.4); using the input signal, producing an input measurement signal (signal 10); and mixing input measurement signals with output measurement signals representing a phase difference between the input measurement signal and the output measurement signal (phase error signal 84).

However, Wessel does not explicitly teach wherein the phase error signal is represented in in-phase and quadrature components, and wherein the input measurement signal (signal 30) exhibiting varying phase and a substantially constant envelope; shifting one of the output measurement signal and the input

measurement signal by substantially 90 degrees to produce a quadrature measurement signal.

Khatibzadeh teaches providing an input measurement signal (signal 422 in Fig.4 provided to elements 430 and 440, thus providing signals exhibiting varying phase and a substantially constant envelope at its respective outputs) shifting one of the output measurement signal and the input measurement signal by substantially 90 degrees to produce a quadrature measurement signal (element 420 wherein one skilled in the art would recognize that the in-phase signals are 90 degrees offset from the quadrature signals), and further suggests wherein the signals in the system are represented in in-phase and quadrature form. Khatibzadeh further suggests that by providing the signals in in-phase and quadrature form allows separate tracking of the phase and amplitude at elements 430 and 440 (note c.4, l.42-64). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the teaching of Khatibzadeh in the system of Wessel of representing the signals in in-phase and quadrature form in order to allow separate tracking of the phase and amplitude at elements 430 and 440 (note c.4, l.42-64). The recitation in the preamble is not given patentable weight since the recitation recites the intended use of a structure and the body of claim does not depend on the preamble for completeness and the bodily limitations are able to stand alone.

Regarding claim 2, Wessel teaches a method of generating feedback information in IQ (In-phase and Quadrature) form for linearity compensation of a communications transmitter using polar modulation and having a communications signal amplifier having an input signal and producing an output signal (see Fig.4), comprising: using the output signal, producing an output measurement signal (signal 50 in Fig.4); using the input signal, producing an input measurement signal (signal 10); and mixing input measurement signals with output measurement signals representing a phase difference between the input measurement signal and the output measurement signal (phase error signal 84).

However, Wessel does not explicitly teach wherein the phase error signal is represented in in-phase and quadrature components, and wherein the input measurement signal (signal 30) exhibiting varying phase and a substantially constant envelope; shifting one of the output measurement signal and the input measurement signal by substantially 90 degrees to produce a quadrature measurement signal.

Khatibzadeh teaches providing an input measurement signal (signal 422 in Fig.4 provided to elements 430 and 440, thus providing signals exhibiting varying phase and a substantially constant envelope at its respective outputs) shifting one of the output measurement signal and the input measurement signal by substantially 90 degrees to produce a quadrature measurement signal (element 420 wherein one skilled in the art would recognize that the in-phase signals are

90 degrees offset from the quadrature signals), and further suggests wherein the signals in the system are represented in in-phase and quadrature form. Khatibzadeh further suggests that by providing the signals in in-phase and quadrature form allows separate tracking of the phase and amplitude at elements 430 and 440 (note c.4, l.42-64). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the teaching of Khatibzadeh in the system of Wessel of representing the signals in in-phase and quadrature form in order to allow separate tracking of the phase and amplitude at elements 430 and 440 (note c.4, l.42-64).

However, Wessel in view of Khatibzadeh does not explicitly teach wherein the phase-modulated signal and the amplitude signal are implemented by a polar modulator.

It is well-known in the art that polar modulation is analogous to quadrature modulation in the same way that polar coordinates are analogous to Cartesian coordinates. Quadrature modulation makes use of Cartesian coordinates, x and y. When considering quadrature modulation, the x axis is called the I (in-phase) axis, and the y axis is called the Q (quadrature) axis. Polar modulation makes use of polar coordinates, r (amplitude) and Θ (phase).

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to implement polar modulation in replacement to quadrature modulation. Applicant has not disclosed that such implementation provides an advantage, is used for a particular purpose or solves a stated problem.

One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with quadrature modulation because both provides equivalent modulation types, but simply differ in signal formats. Therefore, it would have been obvious to one of ordinary skill in this art to modify quadrature modulation with polar modulation to obtain the invention as specified in the claim.

The recitation in the preamble is not given patentable weight since the recitation recites the intended use of a structure and the body of claim does not depend on the preamble for completeness and the bodily limitations are able to stand alone.

4. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeckeln et al. US 2002/0191710 A1 (Jeckeln) in view of Booth et al. US 6,512,417 B2 (Booth) and Wessel et al. US 6,275,685 B1 (Wessel).

Regarding claim 3, Jeckeln teaches a communications signal transmitter (transmitter in Fig.1) for transmitting a data signal (transmitting data from source 22), comprising: a data modulator (IQ modulator 46 receiving the data from the source 22) responsive to the data signal (22) for producing modulated signal components (producing signal 26 modulated by IQ modulator) including a magnitude component and a periodic signal containing a phase component (note paragraph 0064 wherein the IQ modulator has the magnitude component and the phase component or an amplitude and a phase, respectively, distorted by a pre-distorter 42, hence the output of the IQ modulator include the magnitude

component and the phase component or the amplitude and the phase, and the phase component is a periodic signal, since the amplitude and phase output of the IQ modulator represents signaling per symbol); an amplifier (power amplifier 34) responsive to the magnitude component and the periodic signal for producing a desired communications signal (the output of the IQ modulator comprising the amplitude and the phase are input to the power amplifier 34 and outputting the desired communications signal 32); and feedback circuitry (feedback loop path from 50 and 56 through 48) responsive to the communications signal (32 or 24, output from power amplifier 34) and to the periodic signal (26) for producing feedback signal components in quadrature relation (Fig.2 further illustrating the components of the feedback loop path, the feedback signal output from 60 and 54 in Fig.2 having quadrature relation through the quadrature local oscillator 64, note paragraph 0072), the feedback signal components (the feedback signal output from 60 and 54 in Fig.2) are phase compared between the communications signal and the periodic signal (note paragraphs 0064 and 0065). However, Jeckeln does not explicitly teach wherein the phase comparison is to determine a phase difference between the communications signal and the periodic signal.

Booth teaches, in the same field of endeavor, a predistorter (70 in Fig.7) coupled to a phase error detector (60) receiving signals before (42) and after (54) a power amplifier (22) wherein the phase error detector computes for a phase error or a

phase difference (see Fig.8 wherein the output of the phase comparator 630 determining the phase difference between α of 42 and β of 54).

Hence, both Jeckeln and Booth teach a predistorter computing predistortion signal (94) based on signals before and after the power amplifier, wherein Booth further suggests that the predistortion signal is determined based on a phase difference between the signals before and after the power amplifier for proper error detection and compensate for changes in the power amplifier phase characteristic (note col.11, lines 50-51). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the teaching of Booth of determining the phase error between the signals before and after the power amplifier by the element 62 in Fig.1 of Jeckeln), wherein the phase error could be very well be computed through the previously explained step of the phase compared step, for the purpose of proper error detection and compensate for changes in the power amplifier phase characteristic (note col.11, lines 50-51).

However, Jeckeln in view of Booth does not explicitly teach a feedback circuitry. Wessel teaches using output signal, producing an output measurement signal (signal 50 in Fig.4); using the input signal, producing an input measurement signal (signal 10); and a feedback circuitry mixing input measurement signals with output measurement signals representing a phase difference between the input measurement signal and the output measurement signal (phase error signal 84). Wessel further suggests that the feedback circuitry provides gain and

phase errors for optimal pre-distortion functions (note c.7,l.4-12). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the teaching of Wessel in the system of Jeckeln in view of Booth of implementing the feedback circuitry for the purpose of providing gain and phase errors for optimal pre-distortion functions (note c.7,l.4-12).

Regarding claim 4, Jeckeln further teaches wherein the feedback circuit (feedback loop path from 50 and 56 through 48) comprises: first and second mixers (two mixers coupled to 58 in Fig.2); a first pair of signals (two parallel signals output from 58) derived from the communications signal (derived from 56 coupled to receive the communications signal 24 in Fig.1), a different one of the first pair of signals being applied to each of the mixers (each mixer receiving its respective signal from 58); and a second pair of signals (two parallel signals output from 52) derived from the periodic signal (derived from 50 coupled to receive the periodic signal 26 in Fig.1), a different one of the second pair of signals being applied to each of the mixers (each mixer receiving its respective signal from 52); wherein the signals of at least one the first and second pair of signals are in quadrature relation to one another (the signals are multiplied by the quadrature local oscillator 64).

Regarding claim 5, Jeckeln further teaches the modulator further comprises: a correction table (look-up tables 70,72 in Fig.3) for correcting the magnitude

component and the phase component (coupled to Mag and Phase and further to the IQ Modulator for correcting the output of the IQ Modulator, note paragraph 0064 wherein the IQ modulator has the magnitude component and the phase component or an amplitude and a phase, respectively); and adaptation means (62 in Fig.1) responsive to the feedback signal components (the feedback signal output from 60 and 54 in Fig.2) for adapting values of the correction table (the inputs to 70,72 in Fig.3 from 60,54 in Fig.2, supplying correction factor, note paragraph 0064).

5. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jeckeln et al. US 2002/0191710 A1 (Jeckeln) in view of Booth et al. US 6,512,417 B2 (Booth) and Wessel et al. US 6,275,685 B1 (Wessel) and in further view of Tapio et al. US 6,741,663 B1 (Tapio).

Regarding claim 6, Jeckeln in view of Booth and Wessel teaches all subject matter claimed, as applied to claim 5, however, does not explicitly teach wherein the adaptation means is based on a statistical algorithm.

Tapio teaches (see Fig.2), in the same field of endeavor, determining predistortion signal (output of 108 supplied to 100) based on signals before (output of 98 provided to 114) and after (output of 118) a power amplifier (104) and further teaches adaptation means (120) based on a statistical algorithm (Least Mean Square algorithm, note col.4, lines 1-11). Hence, Jeckeln and Tapio teach adaptation means wherein Tapio further suggests that the adaptation

means is based on the statistical algorithm in order to minimize error or difference between the signals before (output of 98 provided to 114) and after (output of 118) a power amplifier (104, note col.4, lines 1-5). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to incorporate the adaptation means of Tapio in the adaptation means of Jeckeln for the purpose of minimizing error between the signals before and after the power amplifier, as taught by Tapio (note col.4, lines 1-5).

Regarding claim 7, Tapio further teaches wherein the statistical algorithm is the least mean squares algorithm (Least Mean Square algorithm, note col.4, lines 1-11).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sam Ahn whose telephone number is (571) 272-3044. The examiner can normally be reached on Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on (571) 272-3021. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Sam K. Ahn
Patent Examiner
6/10/07